I asked Dr. William Thomson to reëxamine his eyes. Briefly, he had no insufficiency, but there was in the right eye hypermetropic astigmatism of three-quarters of a dioptric axis at 75°, and in the left myopia of one dioptric and hypermetropic astigmatism of 2.5 dioptric axis at 100°. There was no marked gain from any treatment, and I have not seen the case for some time.

Our present state of knowledge, or want of knowledge, makes comment difficult as regards these cases. Why should the zigzag lines or the catherine wheel be so common, and how shall we explain why in rare cases the storehouse of memory sets free for visual projection strange figures long unremembered? The phenomena are not uncommon in disease, but their association as part of the complex symptom, hemicrania, is undescribed. The connection of epilepsy and prodromic visions I have often seen. Finally, one is tempted to ask if some ghost stories may not arise out of these rare examples of headaches preceded by hallucinations.

ATROPHY OF THE GASTRIC TUBULES: ITS RELATIONS TO PERNICIOUS ANÆMIA.

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As early as 1860 Dr. Austin Flint[1] suggested the probable dependence of the group of cases known as pernicious anæmia upon degenerative disease of the gastric tubules, and ventured to predict that eventually this opinion would be corroborated. Investigations of morbid changes in the mucous membrane of the stomach had previously been reported in England by Drs. Hanfield Jones,[2] Wilson Fox,[3] and Habershon,[4] and in Germany particularly by Dr. F. Schäpfer.[5] They did not consider, however, the marked and different changes found with reference to the anatomical characteristics of any particular disease or diseases.

In 1865 a memoir by Dr. Samuel Fenwick[6] was published on the "Morbid Changes in the Stomach and Intestinal Villi present in Persons who have died of Cancer." The histological changes found by him in many of his cases were very similar to those described by the previously mentioned observers, viz., disappearance of the cells in the gastric tubules, granulo-fatty degeneration and atrophy, and an increased formation of connective tissue. He also noted a marked thinning of the mucous membrane and decrease of its weight. The above changes were more marked in those patients who had suffered from cancer of the breast. He suggested that these alterations in the secretory structures of the stomach offered a possible explanation of the anæmia which accompanies malignant disease.

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[1] Degenerative Disease of the Glandular Tubuli of the Stomach, American Medical Times, September 15, 1860.

[2] Observations of Morbid Changes in the Mucous Membranes of the Stomach, Medico-Chirurgical Transactions, vol. xxxvii., 1854.

[3] Contributions to the Pathology of the Glandular Structures of the Stomach, Medico-Chirurgical Transactions, vol. lxi., 1858.

[4] Cases Illustrating the Pathology of the Stomach, Guy's Hospital Reports, Series III., vol. i., 1853–1855.

[5] Virchow's Archiv, vol. vii.

[6] Medico-Chirurgical Transactions, vol. xlviii.

In 1877 four cases of pernicious anæmia were reported by Dr. Fenwick[1] (including one previously reported by Dr. Hanfield Jones), in which marked and very general atrophy of the gastric tubules was found. The only other cases presenting the clinical picture of progressive pernicious anæmia and associated with atrophy of the gastric mucous membrane, which I have been able to find recorded, are two by Nolen,[2] one by Quincke,[3] one by Brabazon,[4] one by Henry and Osler.[5] Nothnagel has reported a case of cirrhosis of the stomach with the clinical symptoms of pernicious anæmia.[6] In some of these cases the histological investigations lack desirable completeness. During the past two years three cases of pernicious anæmia have come under the author's observation in the wards of St. Luke's Hospital. The patients were carefully observed over very considerable periods of time, and in two of the cases autopsies were obtained.

The histories well illustrate the group of symptoms which have come to be regarded as pathognomonic of pernicious anæmia, and the histological investigations would seem to confirm the opinion which has been expressed by several observers, that "a primary degeneration and atrophy of the gastric tubules occurs," and that extensive destruction of the secretory structures of the stomach may be regarded as causal in a certain number of cases of pernicious anæmia.

Case I.—J. T., male, aged forty-six, carpenter. Admitted to St. Luke's Hospital April 9, 1886. Family history negative. The patient stated that he had been a moderate drinker; denied venereal disease. For the past five or six years his appetite had been poor, and he had suffered from constipation. He had been troubled with vomiting "off and on" during this period, and thought that he had gradually lost flesh. For the last two years he had had much headache, and occasional attacks of loss or marked dimness of eyesight. Six months ago he began to be troubled with breathlessness on slight exertion, his feet became swollen, and he was obliged to give up work. The dyspnœa persisted, but the œdema gradually disappeared, and he was able temporarily to return to work. For the past month he has again been worse; he has been very weak and confined to his bed the greater portion of the time.

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[1] Fenwick: London Lancet, 1877, vol. ii.

[2] Centralblatt f. d. medicinische Wissenschaften, Bd. xx.

[3] Quincke: Volkmann's Samml. klin. Vortrage, No. 100 (Case b).

[4] Brabazon: British Medical Journal, 1878, July 27 (without microscopical examination).

[5] Henry and Osler; American Journal of the Medical Sciences, April, 1886.

[6] Nothnagel: Deutsches Arch. f. kl. Med., Bd. 24, p. 353.

On admission to the hospital the patient was very weak, and suffered from breathlessness and palpitation on the slightest exertion. There was extreme pallor of the skin of the trunk and extremities, with the peculiar lemon-tint of the skin of the face which obtains very constantly in pernicious anæmia. The ocular conjunctiva was of the latter hue, the palpebral conjunctiva milky white, apparently bloodless, as were the other visible mucous membranes. There was slight œdema about the ankles and puffiness about the eyes, and slight œdema of the skin of the entire body. The heart's apex was in the fifth space, within the mammillary line; a soft systolic murmur was heard over the mitral area, and a similar one over the pulmonary area. There was no evidence of pulmonary disease, and the areas of hepatic and splenic dulness were apparently normal. There was a slightly enlarged gland at the angle of the jaw on each side, sensitive on pressure. The superficial glands elsewhere were not enlarged. There was an absence of external evidence of syphilis. The patient was emaciated; the abdominal walls, however, contained a fair amount of fat. The pulse was 84, and was soft and compressible; there was no appreciable thickening of the walls of the superficial arteries. The temperature (in mouth) was 99.2°. The urine was free from albumen, sugar, and bile pigment. Specific gravity 1.020. Microscopic examination negative. Examination of the blood, April 17th: Number of red globules per cubic millimetre 2,225,000 (5,000.000 normal), hæmic unit therefore 44.5. Proportion of white to red globules 1:130. Percentage of hæmoglobin (estimated by Gower's hæmoglobinometer) 35. The red blood globules were round, oval, and pear-shaped, and many were much larger than normal. Microcytes were present in considerable number; only an occasional Schultze's granule mass was seen. The patient had two rather profuse hemorrhages from the bowels on the day of admission. Arsenic, iron, and daily inhalations of oxygen, with a milk diet, were ordered.

April 28th. The patient's condition is very much the same as on admission. Examination of the blood: Number of red blood globules per cubic millimetre 2.451.000, hæmic unit 49. Proportion of white to red 1:123. Percentage of hæmoglobin 40.

May 21st. Has steadily grown worse. The enlargement of the glands at the angle of the jaw has disappeared. There is distressing palpitation and dyspnœa on slight exertion. The cardiac murmurs have increased in intensity, and a loud systolic murmur is heard over the vessels of the neck. The first sound of the heart is markedly feeble, pulse 102. Temperature normal. The daily average excretion of urine is 56 ounces. (The patient takes nearly two quarts of milk daily.) Occasionally a trace of albumen is present, but no casts have been found at any time. The daily average excretion of urea is about seven grains to the ounce. Examination of blood: Number of red globules per cubic millimetre 1,067,000, hæmic unit 21.3. Proportion of white to red, 1:107. Ophthalmoscopic examination by Dr. Edward Loring: The fundus of the left eye is hazy and indistinct, the nerve is very pale, the capillary circulation is almost nil; it has the whiteness of atrophy, but appears more woolly. The arteries are reduced in size, and are almost white, with broad white reflex. The veins are increased in size, and are tortuous, carrying their size far into the retina and tapering at the disk. The arteries and veins are of nearly the same color on the disk; the veins are much darker in the retina. There is no pulsation in either veins or arteries. There is pulsation in both veins and arteries on pressure. There is no general retinitis or neuro-retinitis. There is an absence of white plaques. There is no swelling of the disk. The fundus of the eye presents the same appearance of pallor as the face. The right eye is the same as the left.

June 19. The patient's condition is worse. There is gradually increasing œdema of the lower extremities and of the face. Pulse 124 and exceedingly weak; temperature, 100$\frac{3}{5}$°. Complains of a "woolly" feeling in the ears and of dimness of eyesight. Examination of blood: number of red blood globules per cubic millimetre 948,881, haemic unit 18.9. Proportion of white to red 1:124. Percentage of hæmoglobin 11.5 (the extremely pale tint of the blood may have vitiated the correctness of the color test). The arsenic, the dose of which had been gradually increased, and the iron were discontinued, and caffeine, digitalis, and whiskey (three ounces daily) were ordered.

27th. There has been marked improvement in the patient's condition since the last note. The œdema has, to a great extent, disappeared, the pulse is markedly stronger and 96, temperature normal. The patient expresses himself as feeling "a hundred per cent. better." Examination of the blood: number of red globules per cubic millimetre 1,133,750; hæmic unit 22.6. Proportion of white to red, 1:203. Percentage of hæmoglobin 20. Microscopic examination shows similar forms of globules to those previously noted.

July 7. The improvement has been maintained. The patient is again taking arsenic and to-day enemata of defibrinated beef blood, eight ounces daily, are ordered in addition. Examination of blood: number of red blood globules per cubic millimetre 2,163,400; hæmic unit, 43.2. Proportion of white to red, 311 red counted, no white seen. Percentage of hæmoglobin 39.

22d. Has still further improved. Is able to be up and about and has been absent from hospital on leave on several occasions. The mucous membranes are not as absolutely bloodless as has been the case hitherto. Temperature 99.2°. There has been no increase in the patient's weight. The daily percentage of excretion of urea has slightly increased since the administration of the beef blood; the amount of urine voided has maintained its former average. Examination of blood: number of red globules per cubic millimetre 2,072,525; hæmic unit, 41.4; percentage of hæmoglobin 40. The majority of the red globules are certainly larger than normal and many are pear-shaped and oval.

August 8. The patient is again worse. There is again great weakness and much œdema. Temperature 103°. Examination of blood: red globules per cubic millimetre 1,161,400; hæmic unit 23.2; proportion of white to red 1:288; percentage of hæmoglobin 26.

September 4. There is little or no change in the patient's condition. Temperature normal. Examination of blood: number of red globules per cubic millimetre 1,328,450; hæmic unit 26.5; proportion of white to red, 254 red counted, no white seen; percentage of hæmoglobin 33.

18th. The patient's condition remains the same. Temperature 99.3°. Examination of blood: number of red globules per cubic millimetre 1,351,687; hæmic unit 27; proportion of white to red, 320 red counted, no white seen; percentage of hæmoglobin 30. On this date the patient was discharged from hospital with the understanding that he should still remain under observation.

He was seen from time to time during the succeeding three months. He was able during the greater portion of this period to be up and to walk moderate distances without much distress. During the early part of December he began to be troubled with diarrhœa, the œdema again became troublesome, he rapidly grew weaker, there was much dyspnœa and palpitation, and on December 21st, he was readmitted to the hospital.

On this date the results of physical examination were much the same as on the patient's first admission to the hospital except that the emaciation was greater. The murmurs heard over the cardiac area and over the vessels of the neck were more intense in character, there was moderate œdema of the lower extremities and of the whole integument. The patient was very weak, pulse 90, temperature normal. The urine was free from albumen, sugar, and bile pigment, specific gravity 1.011, acid.

Ophthalmoscopic examination by Dr. Loring. The blood in the arteries is very light colored, and on the disk of a milky appearance. The reflex on the veins is broad and of a white color, as if the walls of the vessels were affected. There are some small decolorized hemorrhages or exudations. There is a marked arterial pulse on pressure. The upper artery becomes blanched on pressure. The vessels in the retina have a waxy appearance, possibly due to changes in their walls. Examination of blood: number of red globules per cubic millimetre 930,000; hæmic unit 18.6; proportion of white to red 1:107; percentage of hæmoglobin 10.

From this date the patient gradually failed, effusion gradually occurred in the pleural cavities, there was vomiting from time to time of matter of the color of chocolate, and death finally occurred on January 19th. Four days previous to death a distinct icteroid tint of the conjunctivæ and skin was developed. The daily average excretion of urea was almost indentical with that noted on the patient's previous stay in hospital. Throughout the whole period of observation there was marked anorexia, but little epigastric distress or vomiting after the ingestion of food, until the last days of life. Milk constituted the principal article of diet.

It was ascertained from the patient's friends, after his death, that he had been a hard drinker for many years.

The autopsies and histological investigations in both cases were made by Dr. Frank Ferguson, the pathologist of the hospital, and to him the author is greatly indebted for the time and labor given to the task.

Autopsy twenty-eight hours after death. The body was extremely emaciated, and its surface very anæmic, and slightly jaundiced. There was no œdema. Rigor mortis was present. The muscular tissue of the abdominal wall was anæmic and flabby. The peritoneum was pale, but otherwise normal.

Pleural cavities. There were twenty-four ounces of straw-colored serum in each, and there were old adhesions at each apex.

Heart. There were eight ounces of straw-colored serum in the pericardium. The heart was slightly increased in size. Its muscular tissue was flabby and anæmic. The heart muscle contained a great deal of fat. The ventricles were dilated; the auricles were also dilated, but to a less degree;

all the cavities contained partially decolorized clots. The valves were normal. The coronary arteries were normal.

Lungs were intensely œdematous. The fluid oozing from the cut surface was stained with bile. They were otherwise normal.

Spleen was normal in size and firm in consistency, but very anæmic.

Kidneys were normal in size, and firm in consistency. The capsules were not adherent, the surfaces were smooth, the markings were not distinct. They were anæmic.

Suprarenal capsules were normal in size; the cortex of each contained a great deal of fat. The medullary portion appeared normal.

Stomach was moderately distended with gas, and it contained a small amount of dark-colored fluid. It was normal in size, and the calibre of the pylorus was normal. The wall of the stomach, where it was in contact with its fluid contents, appeared thinner than normal. The veins beneath the mucous membrane were unusually prominent. The mucous membrane in the neighborhood of the pylorus was slightly thicker than at the fundus. The surface of the mucous membrane was smooth, and the stomach wall throughout was very anæmic. The œsophagus was normal.

Pancreas was anæmic. It was normal in size; it was slightly stained with bile.

Intestine. The mucous membrane of the small intestine was covered with mucus. It was anæmic and pigmented. The large intestine was filled with soft feces of a metallic lustre.

Thoracic duct was normal.

Liver was small, weighing two and three-quarters pounds. It was generally stained with bile. There was much fat arranged around the periphery of the lobules. It was very anæmic. The gall-bladder contained mucus. Its duct was impacted with a black calculus, one inch in diameter. There were other smaller calculi in the common duct, but its muscular wall and mucous membrane appeared normal. The orifice of the common duct was pervious.

Head and brain. The calvaria were normal. The brain was intensely anæmic. There was slight atrophy of the convolutions over the vertex of both hemispheres. The Pineal gland was very small. There was an absence of the soft commissure.

Sympathetic system. The semilunar ganglia were normal in appearance.

Marrow. There was no difference in the color and consistency of the marrow of the long and short bones. In both locations it closely resembled the normal marrow of the short bones. There was no fat in the marrow of the long bones.

HISTOLOGICAL EXAMINATION.—*Heart.* Small portions of the muscular wall of the auricles were teased, and considerable fat in small globules was seen in the cardiac cells. The auricles showed an equal degree of fatty degeneration. In fresh sections of the wall of the left ventricle, whole areas of the cardiac muscle were seen in the condition of fatty degeneration. Everywhere the transverse striæ were absent, and the cardiac cells were granular, and many of these appeared like small tubes filled with fat granules. There was an equal degree of fatty degeneration in the walls of both ventricles, and it was more marked than in the auricles.

Kidneys. There was a great deal of fat in the convoluted tubes of the kidney. The epithelium was everywhere swollen, granular, and fatty. The fatty degeneration was especially well marked in the cortex. There was no increase in the fibrous tissue, but numerous small, round cells, of inflammatory origin were seen in the stroma of the organs.

Adrenales. There was much fat in circumscribed areas in the cortex of each suprarenal capsule. In some places the proper cortex of the capsules was completely replaced by fat.

Pancreas. There was a slight increase in the fibrous tissue of the pancreas. There was considerable fat arranged as follows: 1. A very considerable quantity between the acini, in the planes of the fibrous tissue. 2. There were large globules of fat seen by the unaided eye within the acini. This fat in the recent state was of brownish color, and the globules showed many lines of constriction, as in the process of division and subdivision. 3. The cells of the gland contained very fine granules of fat. The cells were swollen.

Liver. There was a great deal of fat in the liver. The fat was more abundant at the periphery of the lobules, but everywhere the hepatic cells contained a large number of fat granules. There was brown pigment in the cells in the centres of the acini. There was bile pigment in all the lobules. The large bile-ducts, which were easily distinguished under the microscope, were normal.

Ganglia of the sympathetic. The ganglion cells were deeply pigmented; in other respects the cells were normal. There was no change noticed in the nerve fibres or fibrous tissue.

Stomach. The walls of the stomach, including all its coats, appeared so natural that no effort was made to measure their thickness in the fresh state. Any measurements of either the mucous membrane or muscular wall of the organ, after stretching on cork and hardening in alcohol, can only be regarded as useless, since the thickness materially depends on the degree of tension to which the organ is submitted in thus preparing it for microscopical examination. Numerous sections were made of the stomach wall in the neighborhood of the pylorus; at the distance of two, four, six, and ten centimetres above the pylorus, along the greater and lesser curvatures; of the anterior and posterior walls, in the midzone of the stomach; of the different parts of the fundus not in contact with the fluid, and in the neighborhood of the œsophagus, and the following conditions of the mucous membrane were found in all the sections examined. In extensive areas of the mucosa not a trace of the gastric tubules could be seen. In places, however, the most superficial parts of the gastric tubes, lined with cylindrical epithelium, could be distinguished. The deeper portions of the tubules could nowhere be made out. In the recent state the cells lining these remnants of tubules were granular and fatty. There was a large amount of fat in the stroma of the mucous membrane in very fine granules. There was considerable hyaline material, resembling the hyaline casts of the renal tubes. This material was seen in places in droplets, in places having, apparently, the shape of the tubes. Osmic acid did not stain it readily, and ether did not dissolve it. It was slowly stained by Bismarck-brown and the aniline colors. It was dissolved by the prolonged action of ninety-five per cent. alcohol. Numerous cells were seen near the surface of the mucosa, which were irregular in shape, and of the same size as the cells which lined the deeper portions of the gastric tubules. Some of these had undergone hyaline degeneration. Throughout the mucosa everywhere were large numbers of small triangular bodies, slightly larger than pus cells, without nuclei. These were isolated in places, but were more frequently found in groups. They behaved to reagents much the same as the hyaline material already noticed. The fibrous tissue of the mucosa was not increased.

In addition to the elements already noticed, the mucous membrane was everywhere infiltrated with the small round cells so common in inflammatory processes.

The only difference noticed between the sections from the various regions of the stomach was that the remnants of a greater number of tubes were seen in the pyloric zone; but nowhere were the secreting structures proper to the stomach noticed. The muscularis mucosæ appeared normal. There was a very moderate amount of fat in the submucosa. The submucosa otherwise appeared normal. The muscular wall of the stomach appeared normal. The vessels were normal.

Intestines. Sections of the duodenum, jejunum, ileum, and colon were examined, and no special change was noticed.

Marrow. There was no fat in the marrow of the short bones. There were seen in it all the other elements normally found in this location, and also numerous small cells without nuclei, spheroidal in shape, and paler than red corpuscles. Nucleated red corpuscles were not present. A few of the Charcot-Neumann crystals were present. The bone framework supporting the marrow was normal. The marrow of the long bones contained no fat. Small, round, colored corpuscles, similar to those found in the marrow of the short bones, were noticed. Also several Charcot-Neumann crystals.

The tissues of the *eye* were carefully examined, and Dr. Loring has kindly sent the following report:

Beyond a certain dimness of the nervous elements, they appeared normal. There was no increase of the connective tissue either in the nerve or retina. The vessels were normal, arteries as well as veins showing neither thickening nor degeneration of their walls. They contained, however, very little, if any, blood. No red blood-cells were seen in either the retina, the choroid, or ciliary vessels around the nerve. The choroid and sclera appeared normal.

RÉSUMÉ.—*Clinical.* A history of a possibly excessive use of alcohol for many years, of anorexia and gastric disturbance for five or six years, of marked anæmia, and failing health and strength, and of emaciation during the six months previous to the patient's admission to the hospital. The occasional occurrence of hemorrhages, the presence of an irregular temperature curve, gradually increasing emaciation and prostration, with brief periods of improvement while the patient was under observation. Red blood-globules finally reduced to 930,000 per cubic millimetre, the relative percentage of hæmoglobin remaining normal. Megalocytes and poikilocytes in the blood in large numbers, microcytes in considerable number. Death by asthenia, nine months after admission to the hospital.

Anatomical. Extreme emaciation and anæmia, fatty changes in all the viscera, an absence of fat in the marrow of the long bones, almost complete destruction of the gastric tubules.

CASE II.—C. M., aged thirty-seven, salesman, was admitted to St. Luke's Hospital July 14, 1886. The patient's family history was negative. With the exception of an attack of acute articular rheumatism in 1874 and two attacks of gonorrhœa, the last one in 1883, the patient stated that he had enjoyed excellent health until about eight months ago. He denied venereal disease, other than that mentioned above. Periodically, he had used alcohol in great excess. His weight, in December, 1885, was 190 pounds. Four months ago, he began to lose flesh and his appetite and strength became impaired. At this time he was in the habit of taking alcohol, in one form or another, before breakfast. The anorexia increased, until two months later he was unable to take any solid food; forced attempts were followed by vomiting. Gradually great breathlessness and palpitation on slight exertion were developed.

On admission to the hospital, the patient was much emaciated and weak. His weight was 131 pounds. There were marked dyspnœa and palpitation on slight exertion. The skin was extremely pallid as were the visible mucous membranes. The heart's apex was in the fifth space, within the mammillary line; there was an absence of murmurs. There was no evidence of pulmonary disease. The areas of hepatic and splenic dulness were apparently normal. There was slight enlargement of the inguinal and post-cervical glands. There was moderate sensitiveness on pressure over the epigastric region. The pulse was 90, short and compressible. There was no evident thickening of the walls of the superficial arteries. There were no cicatrices on the glans penis or in the groins. The urine was free from albumen, sugar, and bile pigment—specific gravity 1.022.

An examination of the blood was not made until August 14th. On this date the number of red blood-globules per cubic millimetre was 1,862,325, hæmic unit, therefore, 35.2; proportion of white to red globules, 233 red counted, no white seen; percentage of hæmoglobin 30. The red globules were round, oval, and pear shaped. Microcytes were present in considerable numbers.

August 16. The area of splenic dulness reaches, anteriorly, the anterior axillary line, indicating apparently an increase in size of the spleen since admission. The enlargement of the inguinal and post-cervical glands remains unchanged.

24th. Examination of the blood: Number of red blood-globules per cubic millimetre 1,461,825, hæmic unit 29.2, proportion of white to red, 329 red counted, no white seen.

Poikilocytes are very numerous, megalocytes and microcytes are present in considerable numbers.

September 14. The patient's condition has steadily grown worse since admission. The temperature is normal. Examination of blood: Number of red globules per cubic millimetre 1,020,950, hæmic unit 20.4; proportion of white to red not increased. Percentage of hæmoglobin 25.

28th. Ophthalmoscopic examination by Dr. Loring. The capillary circulation of the disk is very much reduced. The color of the blood in the veins is very much lighter than normal, corresponding in appearance to arterial blood in the normal eye. The blood in the arteries is lighter than normal. The disk looks atrophic. There are hemorrhages in the upper ascending vein and below the region of the macula, also capillary hemorrhages near some of the veins, and here and there in spots in the upper and outer quadrant of the field. The external borders of both veins and arteries are not clearly marked, the edge being ragged. There is little or no œdema anywhere, and there is an absence of swelling of the retina.

In spite of every therapeutic measure, the patient continued to fail. No new symptoms were developed, those present on admission simply increased in intensity. There was complete anorexia and the emaciation gradually increased. Physical examination continued to give the same nearly negative results, with the exception of the increase in the size of the spleen previously noted. The temperature was above normal during a portion of the month of August, the curve being very irregular; during the other periods of the patient's illness, there was apyrexia. The average daily excretion of urine was thirty-six and one-half ounces, the average daily excretion of urea was normal. Owing to unavoidable circumstances, the blood was not examined during the month previous to the patient's death, which occurred on October 20th from asthenia. Judging from the extreme pallor of the skin and mucous membranes, from the increased dyspnœa, palpitation, and prostration, the corpuscular poverty of the blood must have still further increased.

AUTOPSY SEVENTEEN HOURS AFTER DEATH.—The surface of the body was intensely anæmic. Rigor mortis was present. There was no œdema. The surface of the penis showed no cicatrices.

Head. The scalp and calvaria were very anæmic. The brain throughout was normal in consistency, but intensely anæmic. The convolutions were pale and markedly atrophic. There was a great deal of serum in the meshes of the pia mater covering the entire vertex. The vessels at the base of the brain were normal.

There was a very small amount of fat of very pale color beneath the skin, and the muscular tissue in the abdominal wall was of a pale red color. The position of the organs in the abdominal cavity was normal. The peritoneum was anæmic.

Pleural cavities contained no fluid, and there were no pleuritic adhesions.

Heart. The pericardium was anæmic, and contained two ounces of straw-colored serum. The heart was slightly larger than normal: its muscular tissue was pigmented and anæmic, and contained a great deal of fat. All its cavities were dilated, and contained pale yellowish clots and watery blood. The valves were normal. There was a very small amount of pericardial fat. The coronary arteries were normal. The aorta was normal.

Lungs were pale and very œdematous. They were fairly well supplied with air. The bronchial tubes contained frothy mucus and pus. The mucous membrane of the bronchi was intensely anæmic.

Spleen was double the normal size. It was normal in consistency, and deeply pigmented.

Kidneys. The left was larger than normal. The capsule was not adherent; the surface was smooth and pale; the cortex was swollen; and the markings were very indistinct. The right was normal in size; the capsule was not adherent; its surface was a trifle granular and congested; its markings were indistinct. There was fat in the cortex and pyramids of both kidneys.

Stomach contained a small quantity of fluid food. The mucous membrane in contact with the food was macerated, and the veins of the submucosa in the fundus of the stomach were prominent. The mucous membrane of the stomach not in contact with its fluid contents was pale and smooth, and to the unaided eye appeared normal. The stomach wall, especially that portion of it in contact with the fluid, appeared thinner than normal. The calibre of the pylorus was normal.

The *œsophagus* was normal.

The *pancreas* was normal in size, and anæmic.

The mucous membrane of the *duodenum* was pale, and covered with light colored bile. The orifice of the common bile duct was pervious.

Liver was normal in size. The gall bladder was normal. There was a great deal of fat in the liver, and its cut surface was everywhere stained with bile.

Intestines. The mucous membrane of the intestines was anæmic throughout. The muscular wall was normal.

Suprarenal capsules were normal in size; the cortex of each contained a very great deal of fat.

Bladder, urethra, and *thoracic duct* were normal.

HISTOLOGICAL EXAMINATION.—*Heart.* The muscular tissue in the walls of the auricles was granular and moderately fatty.

The muscle of the right ventricular wall contained a great deal of fat; hardly any of the transverse striæ could be seen, and many of the cells had undergone complete fatty metamorphosis. The fatty degeneration was still more marked in the wall of the left ventricle, where extensive areas of muscular tissue had undergone fatty degeneration, and nowhere in them could the transverse striæ be seen. There was only a trace of fat in the planes of fibrous tissue in the ventricular walls. The bloodvessels were normal.

Suprarenal capsules. There were extensive areas of fat in the cortex of each organ. In places the parenchyma of the organs had so completely degenerated that only the stroma could be recognized, infiltrated with fat. Some of these areas of fat were very sharply defined, the cortex in their immediate neighborhood being normal. The medulla of each capsule was normal.

Kidneys. The epithelium lining the tubules everywhere had undergone fatty degeneration. The fat was more abundant in the tubes of the cortex and in the collecting tubes. Many of the tubes appeared filled with oil globules of various sizes. There were granular casts in the straight and collecting tubes. The fat was not confined to the tubules, but was seen in very fine globules in the stroma. When hardened in alcohol and stained with carmine, the stroma was seen to contain many small round cells, in places, in aggregations of considerable size.

Spleen. The microscopic examination of the spleen was negative.

Liver. There was a very great deal of fat in the liver. Very generally the fat was evenly distributed throughout the lobules; some of the lobules, however, were more fatty at the periphery than in the interior. The central vessels were dilated, and the liver cells in their neighborhood were atrophied.

Brain. The microscopical examination of the vessels of the brain revealed nothing unusual.

Sympathetic ganglia. The ganglia of the sympathetic nerves were normal.

Stomach. The mucous membrane of the stomach consisted of a stroma everywhere infiltrated with the small, round cells so common in inflammatory processes. Sections for microscopic examination were made from the pylorus and at varying distances along the greater and lesser curvatures; and of the anterior and posterior walls, to the level of the fluid within the organ. Extensive areas of the mucous membrane presented no trace of the gastric tubules. In none of the sections were normal tubules found; in several, the more superficial portions of the tubules were recognizable, lined with cylindrical epithelium. The epithelium in the recent state was granular and fatty; small granules of fat were seen in the stroma of the mucosa. There were numerous droplets of hyaline material which was soluble in alcohol when submitted to its action for weeks. It was not readily colored by osmic acid. It did not dissolve in ether, and it stained slowly with the aniline colors. This hyaline material in places took the shape of the tubules. Near the surface of the mucosa there were seen irregular flat cells which might be regarded as coming from the deeper portion of the gastric tubules. These were granular and distinctly nucleated. There were numerous small bodies, many of them triangular, highly refractive, the size of pus cells, seen generally distributed throughout the mucous membrane. In places they were aggregated into colonies. They stained very slowly with the aniline dyes, not at all with osmic acid; were dissolved in alcohol after the lapse of seven to ten days.

The submucosa was normal. The muscularis mucosæ was normal.

The muscular wall of the stomach was normal. The bloodvessels were normal.

The intestines were not examined.

Marrow. There was no fat in the marrow of the long or short bones. The marrow in both localities was similar in appearance to the unaided eye, and was the same under the microscope. The absence of fat was the special feature noticeable. There was an absence of multinuclear cells. Several of the Charcot-Neumann crystals were seen in the marrow of both the long and short bones. There were no nucleated red cells seen.[1]

RÉSUMÉ.—*Clinical.* A history of periodical alcoholism; of excellent health previous to eight months before the patient's admission to the hospital; of anorexia and inability to take food for four months; of the symptoms of a gradually developing anæmia and of prostration; of an excessive and rapid loss of flesh. The occurrence of retinal hemorrhages, the presence of an irregular temperature curve; continuous emaciation, and rapidly increasing asthenia during the period of observation. Megalocytes and poikilocytes present in the blood in large numbers; microcytes in considerable number. Red blood-corpuscles finally reduced to 1,020,950; the relative percentage of hæmoglobin remaining normal. Death by asthenia three months after admission to the hospital.

Anatomical. Extreme anæmia and emaciation; fatty changes in all the organs; disappearance of fatty tissue in the marrow of the long bones; almost complete destruction of the secretory tubules of the stomach.

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[1] Dr. Ferguson, during the past two years, has made histological examinations of more than one hundred stomachs of patients dying of various diseases, and he informs me that in this series he has never observed either the presence in the mucosa of the peculiar hyaline material noticed in the above cases, or a similar extensive destruction of the gastric tubules. Pernicious anæmia was not present in any of the cases of the series.

Remarks.—The patients whose histories have been related, presented a clinical picture, in a very typical way, of the group of symptoms which are regarded as pathognomonic of progressive pernicious anæmia.

Both patients gave a history of a probably excessive use of alcohol. The influence of this habit in the production of the pathological process is difficult to determine. In none of Fenwick's[1] cases was there a history of alcoholism; and no mention of it occurs in Nolen's,[2] Quincke's,[3] and Brabazon's[4] cases. On the other hand, the alcoholic habit extended over a period of many years in Henry's and Osler's[5] case, and was regarded by them as "playing a part in the causation of the atrophy." In three out of eleven cases of alcoholism, Hanfield Jones[6] found extensive destruction of the gastric tubules. In Dr. Ferguson's[7] series of one hundred cases, in which a histological examination of the stomach was made, the only considerable degeneration and destruction of the tubules, exclusive of the author's cases, was observed in patients who had suffered from chronic alcoholism.

In both cases the interesting and now well recognized fact in this disease, of a richness in hæmoglobin of the individual corpuscles greatly in excess of that observed in all other forms of anæmia, indeed, equalling that present in health, is clearly illustrated. An increase in the corpuscular richness of the blood and a *proportionate* increase in the percentage of hæmoglobin, corresponding with temporary improvements in the patient's condition, is noticeable in Case I. It will be seen that the average daily excretion of urea was normal, throughout the period of observation, in both cases.

The history in Case I of gastric symptoms, anorexia, and emaciation, distinctly and for a long period *preceding* the appearance of anæmia, and in Case II., the existence of anorexia and inability to take food, with rapid and excessive loss of flesh, also distinctly *antedating* the development of anæmic symptoms, strongly favor the view, from a clinical standpoint, of the *secondary* occurrence of the latter. The pathological considerations in support of the primary nature of the gastric atrophy, will be discussed later. It remains to consider the pathogenesis of the gastric lesion.

That the changes observed in the mucous membrane of the stomach were not due to post-mortem solution or cadaveric change, did not admit of question to the observers. In both cases, all the sections described, were made *above the point of contact* of the fluid in the stomach with the mucous membrane; sections of the lesser curvature and in the immediate neighborhood of the pylorus, showed the presence of changes similar in kind and almost similar in degree to those found in other areas not in contact with the fluid; the mucous membrane above the point of contact with the fluid, presented no trace of superficial softening. The more superficial portions of the glandular structure were those least involved, the greatest destruction affecting the deeper portions of the tubules.[1] A post-mortem solution capable of causing such general destruction of the deeper portions of the secretory structures, would very certainly involve the subjacent tissues; and finally there existed a very general infiltration of the mucous membrane with new elements (small cells of inflammatory origin).

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[1] Loc. cit. [2] Loc. cit. [3] Loc. cit. [4] Loc. cit. [5] Loc. cit. [6] Loc. cit. [7] Not yet published.

Pathological as well as clinical considerations strongly support the view that the very extensive destruction of the gastric tubules cannot be regarded as secondary, and as similar in its origin to the fatty degeneration observed in the other viscera. Extensive fatty changes of the viscera are observed in various chronic non-infectious and acute infectious diseases, with a very moderate degree of fatty degeneration and with little, if any, destruction of the glandular structures of the stomach.

Fatty degeneration of the various tissues of the body is justly regarded in many instances as a consequence of an impediment to, or an arrest of nutrition; *the dense and general small-celled infiltration of the gastric mucosa cannot, however, be regarded as the result of an impaired nutrition, and in itself would account for the degeneration and atrophy of the gastric tubules.*

Gradual destruction of the glandular tissues of the stomach, *consequent* impaired nutrition and fatty changes in the other viscera, would seem to represent the probable sequence in the author's cases.

The supposition of a creeping ulceration in explanation of the gastric lesion is untenable. That the degenerative changes were not dependent upon an arterio-sclerosis or endarteritis, is evident from the absence of appreciable change in the gastric vessels.

Hanfield Jones,[2] as a result of his extensive histological investigations, first expressed the opinion that in some instances "the gastric tubules undergo spontaneous degeneration, or at least not from atrophic pressure of new formed fibroid tissue," and stated that "the mucous membrane then presented a mere mass of granular and colloid débris, with interspersed fat globules and fatty matter." Other observers, who believe that a primary atrophy of the stomach occurs, maintain that it results from interstitial inflammation alone.

In the author's cases the general and very dense small-celled infiltration of the mucous membrane points strongly to the probable dependence of the atrophy upon an inflammatory process. Other elements observed in the gastric mucosa may be regarded as the probable products of degenerating tissues.

A study of the cases related would seem to justify the opinion previously expressed that "a primary atrophy of the gastric mucous membrane occurs, and that in this lesion is to be found an explanation of certain cases of pernicious anæmia."

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[1] A similar condition was observed by Fenwick, Osler, and others.

[2] Loc. cit.

A CASE OF SUBCUTANEOUS NODULES IN THE HANDS OF A RHEUMATIC PATIENT.

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Mrs. L., aged thirty-nine, presented herself at the outdoor department of the Glasgow Royal Infirmary in November, 1886, complaining of rheumatism, and of painful subcutaneous growths on the fingers of both hands.

She had an attack of acute rheumatism when thirteen years of age, and a second in September, 1883. Between these two attacks, and since the last one, she has frequently suffered from rheumatic pains in various joints, such as the knees, ankles, wrists, and finger-joints, accompanied by some swelling of the parts, but not with distinct fever, and not confining her to bed, unless occasionally for a day. There is no cardiac murmur. There is nothing in the history to suggest the existence of a syphilitic taint.

The swellings on the fingers began during convalescence from the second attack of acute rheumatism, in September, 1883. According to the patient's statement, they were not at first permanent, coming and going; but they have been present more or less, as they are now, since early in 1884, though they are said to vary in size and in hardness.

They began as flattened elevations of the skin, and the most recent ones present something of that appearance now. But the majority are distinctly circumscribed tumors, some the size of a pea, others the size of a small hazelnut. The larger ones are lobulated, being apparently composed of two or more that have coalesced. A few of them feel soft and elastic, but in none is there any indication of fluctuation; the rest are hard, like cartilage, but none have either a chalky or a bony hardness. During the eight months she has been under observation, it cannot be said that they have distinctly varied either in size or hardness, although she herself is of opinion that they have.

The most striking swellings are on the flexor aspects of the fingers, which, as will be seen in the woodcut (from a photograph by Dr. Macewen), present something of the appearance of a knotted blackthorn stick. There are between twenty and thirty growths on the fingers of